

BOOK REVIEWS

The Private Life of Plants. David Attenborough. 1995. Princeton University Press, Princeton, NJ. 320 p. \$26.95 hardcover.

Many of us in the scientific disciplines seek out quality programming on television by patronizing various programs on public TV. One of the most successful and popular series in recent years was that of the same title as this publication, *The Private Life of Plants*, which aired in the United States and Canada in 1995. For those who recall this BBC series, this book will be a pleasure to relive that experience through a colorful, amusing, and concisely written text. Those who have not viewed the film series will likely be amazed still further by the ingenuity of plants—with an assist from the processes of evolution. Writer and filmmaker, David Attenborough, has employed extensive color photography (nearly 300 outstanding images) throughout the text, which uses a rather large print and consists of heavy weight paper. Consequently, this attractive and durable book is a quick, thought-provoking read suitable for the coffee table collection.

This book is designed, as was the film series, for the lay audience, though one can easily envision a text such as this being a catalyst for further study in botany, whether at the secondary level or higher. Indeed, the fascinating revelations of reproductive strategies alone may cause college undergraduates to consider this field of science over another. The text is essentially divided into six sections: Travelling, Feeding and Growing, Flowering, The Social Struggle, Living Together, and Surviving. Each section is further defined by pagination breaks, indicated by a centered diamond, when the topic changes. Perhaps because it is taken directly from the film series, one can almost hear the author speaking as the book is read. Not surprisingly, there is a slight anthropomorphic “flavour” to the text, which could be considered annoying to the reader who expects a mechanical, dry portrayal of plant physiology and ecology. Attenborough’s introduction certainly grasps the reader’s attention as he begins, “Plants can see. They can count and communicate with one another.” This statement fully commits the author to validate his words with concrete examples of such attributes, which he does eloquently. For example, “the Venus flytrap closes when its trigger hair is touched not once but twice. It can count.” He thereafter couches these startling words by relating that natural selection is the only accepted evolutionary force that can explain floral phenomenon, not consciousness as we know it in the animal kingdom.

Many plant species described and photographed are familiar to all, such as the coconut palm, dandelion, pitcher plants, sundews, columbine, lichens, cacti, bald cypress, and mangrove. If the text can be said to have a short-coming, it would have to be the cavalier use, or rather disuse, of scientific names included in the text or in photo captions. And when binomials are given they are not italicized or underlined, ostensibly to facilitate reading. The index at the conclusion of the book does

give some binomials, but it is incomplete. On page 97 one is presented with a fine photo of a grass plant releasing pollen in the wind. The caption on the previous page refers to the plant as “meadow grass.” The plant appeared to me quite similar to what is generally referred to as “orchard grass”—*Dactylis glomerata*, in Ohio. Alas, the reader has no recourse to verify this impression.

When taken as a whole, however, the amount of incredible plant interactions with animal life and their surrounding environment leaves the reader with nothing short of awe at the plant kingdom presented herein. Who cannot be taken back by the image of the rare titan arum (*Amorphophallus titanum*), whose flower spathe is three feet wide by four feet tall, while its spadix is nine feet tall! As evidence of plant “communication,” the author relates that African acacias, in addition to thorns, begin producing toxins in their leaves once an animal begins browsing upon them. Simultaneously, the tree releases ethylene gas from the leaf pores, which causes neighboring acacias to manufacture poisons to distribute to their leaves. An herbivore thus must move quickly to forage on acacias before they become inedible. Another amazing aspect of plant physiology involves the tenacity of seeds. It is widely known that seeds often have the capacity to remain dormant for extended periods if temperature or moisture requirements are not met. However, it is still difficult to believe that Arctic lupin seeds excavated from 100,000-year old permafrost layers occasionally germinate! Plant defensive strategies are almost “other worldly” as well. The power of silica incorporated into a plant’s defenses against herbivores is evident in many grasses, species of stinging nettles, and the quite dangerous (that is, venomous) Australian stinging tree (*Laportea* sp.).

While much of the information in this book is strictly biological, there are frequent references to how plants affect humans, or perhaps how humans utilize the world’s flora. In the chapter “The Social Struggle,” Attenborough relates that chemical substances in smoke produced by wild fires have been discovered to be crucial in seed germination in Africa and Australia. Consequently, botanical gardens around the world are now able to germinate seeds that had resisted breaking of their dormancy. In the chapter “Surviving,” the reader is made aware of how engineering has been influenced by a plant. In the mid 19th century Joseph Paxton, an English architect and gardener, designed a large glass greenhouse based upon observation of the ribs and struts of the giant Amazon water lily (*Victoria amazonica*). This species was also the inspiration for his design of the Crystal Palace in London. The 1884 exploration of an isolated mountain plateau in Venezuela with numerous endemic species, known as Roraima, was described so romantically that Arthur Conan Doyle based his 1912 novel *The Lost World* on this remote “island.”

Many of the functions, architecture, and chemistry of worldwide flora described herein may seem excerpted from “Ripley’s Believe It or Not.” A southern African gentian, for example, will only release its pollen when its anther vibrates to the frequency of a carpenter bee’s

wingbeats. Such disclosures certainly have stimulated me into investigating parallel plant strategies among familiar species in local floras. Indeed, too little research has been given to native plants and their biological secrets, as compared to plants of known economic importance.

This engaging book may be the first step in a new enthusiasm for plant biology and may foster a closer analysis of "unremarkable" species from a fresh perspective. *The Private Life of Plants* is a joy to read for the nature enthusiast, and will no doubt inspire the budding high school botanist, as well as the undergraduate in search of a thesis topic.

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Atmospheric Halos. Walter Tape 1994. American Geophysical Union, Antarctic Research Series 64. 143 p. \$40.00.

Walter Tape has produced a delightful book for those of us who like to keep a weather eye on the sky and at the same time have some physical understanding of what is going on. Halos are colored rings around the sun resulting from refraction of light in faceted ice crystals at angles determined by the six-fold (and other) symmetries of the ice crystal lattice. Complications arise to give tangential arcs, sun dogs, and pillars of light resulting from external and internal reflections (as in the ordinary rainbow) coupled with orientation of falling crystals in the form of thin plates or columns of sufficient size to bring in aerodynamic forces. Such particles fall with their maxim area horizontal and oscillate as they grow larger by the shading of eddies in their wake. The 22° halo is the most common of halos, to be seen in cold (-45° C to 60° C) cirrus clouds some 10 km above our heads. At very low surface temperatures, as occur in the Arctic regions, halos may be relatively frequent, with the opportunity for a hardy observer to catch and examine in an ordinary microscope the forms of crystals which may be giving rise to the halo.

The book has clear light ray diagrams of how these phenomena occur. Most interesting are color plates of halos formed in low-level ice clouds, coupled with pictures of ice crystals collected simultaneously. The crystals show the well-developed, large (greater than some tens of microns), flat surfaces in plates and columns which are necessary for the refraction and reflection of light over a sufficient area to give a clearly visible halo. The absence of surface or internal irregularities as shown in the photographs—which do occur on occasion—would minimize light diffraction effects.

A relatively recent approach to understanding light and color intensity distribution in halos is to numerically simulate sunlight processed by individual crystals at random or selected orientation and plotting the resultant spatial distribution. A comparison with actual halo occurrences gives confidence that the assumptions of the model do not depart too far from reality. Many such simulations are shown. Laboratory demonstrations are

also described to simulate halos with solid crystal shapes—rotated to simulate random orientation.

By far the most interesting aspect of the book is the detailed description of halo events. Halo observations have been recorded over the centuries, with interpretation of their having an influence on human affairs. On February 20, 1661, one Johannes Hevelius of Danzig observed and described a spectacular event having a combination of many phenomena with both circum-solar (22° and 45°) and circumzenith halos. Measurements of angles and detailed description enabled the whole display to be simulated. A combination of plates and columns—some having preferred orientation, others oriented at random, together with a known sun angle is made to compare favorably with the observation. All together, some 40 situations are analyzed in this level of detail and compared with photographs of more recent events. They provide a fascinating insight.

As in any good practical discourse, there is a section on how to do it (when taking photographs use slow slide film and block out the sun!) and a section in a minor key which points out some of the remaining mysteries of halos and their formation. It is by no means clear when atmospheric conditions are just right for a good display. It is known that crystals must not be too big—they fall out too quickly—and must not be too small or knobbly because of adverse effects of diffraction. They must be of the right concentration and must have well-defined facets.

Sufficient background is provided for the book to be read on its own; useful references are provided for the more adventurous. It has a good index. I am pleased to have such a volume for reference in thinking about the vagaries of the atmosphere in the years to come.

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Ecology and Conservation of Amphibians. T. J. C. Beebee. 1996. Chapman and Hall, New York, NY. 214 p. \$64.50 hardcover.

This is one of seven books published by Chapman and Hall in their Conservation Biology Series which provides summaries of important topics in conservation such as conservation management, conservation issues, and the monitoring of wildlife and biodiversity. The major objective of the books in this series is to provide conservation specialists, advanced students, and naturalists with precise, reliable, and succinct information on conservation topics. The author of this small book accomplishes these objectives admirably by summarizing knowledge in all areas of amphibian ecology and conservation. Because of space limitations, Beebee acknowledges that his coverage had to be representative and not comprehensive. In spite of this constraint, Beebee, a herpetologist at the University of Sussex whose many publications on amphibian conservation have appeared in such journals as *Nature*, has produced a well-organized, readable book that explains what

amphibians are, why they are important, and how they can be conserved.

The book is logically organized to sell the reader on the need to conserve amphibians. It would be difficult not to become interested in amphibians after reading Beebee's first chapter. Here he describes the basic biology of all amphibians by citing interesting examples of how amphibians sense their environments, how they feed, how they defend themselves from predators, and how they reproduce. His writing style is that of a seasoned researcher as he uses an inquiry approach in asking interesting questions or in providing answers or hypotheses to questions logically asked by the reader. How can amphibians within the Arctic Circle survive the winters? Why do some amphibians have 25 times more DNA than humans? After discussing general characteristics in the amphibia, he then discusses characteristics of the Urodela and Anura, orders to which the salamanders, frogs, and toads, the most familiar of amphibians, belong.

The second chapter asks the question, "Why study amphibians?" This may be the most important chapter in the book. Many conservationists are unaware of the roles amphibians have played as research organisms in studies of development, cytogenetics, bactericidal agents, and ecology. He documents this lack of interest in amphibians by citing the much larger number of members in the Royal Society for the Protection of Birds as compared to the British Herpetological Society. Later in this chapter, he introduces the reader to the phenomenon of global amphibian decline and the relatively new role of amphibians as sensitive biological indicators of environmental problems.

Subsequent chapters on amphibian evolution and phylogeny, behavior, population ecology, and community ecology all present information on topics that must be understood if programs are to be implemented to conserve amphibians. Topics included in these chapters include migration, sexual selection, kin recognition and selection, population study methods, the stability of amphibian populations, population dynamics, population genetics, metapopulations and colonization, the importance of community studies, studies in amphibian

community ecology, and mechanisms of competition. The final chapters in the book apply many of the concepts and generalizations developed earlier to such topics as distribution, abundance, extinction risks, threats to amphibians, how to conserve amphibians, and examples of amphibian conservation practices.

Beebee's writing skills are evident as he makes connections between chapters. In discussing amphibian evolution and phylogeny, he emphasizes that these topics must be discussed because if the major goal of ecology is to explain the distribution and abundance of organisms, then the evolutionary history of the group to which those organisms belong must be understood as well as the relationship between extant groups. The use of undefined terms such as "autotomize" and "cryoprotectant" indicates that the book is not for the layperson but for the advanced student or professional biologist. The book has few negatives; the "parotoid gland" is called the "parotid gland." Teleology rears its ugly head in several of the author's statements, and although the author is unusually thorough in documenting his statements, he fails to cite Heyer et al. (1994), a widely used reference which attempts to standardize censusing techniques and should be included in every discussion of amphibian conservation.

Ecology and Conservation of Amphibians is an excellent book for many people. But I feel its major contribution will be in clarifying the relationship between life history data, major ecological concepts, and species preservation. This relationship may be obvious to the professional biologist but it may not be to the environmental consultant, the conservationist, or the graduate student searching for a meaningful research topic.

LITERATURE CITED

- Heyer WR, Donnelly MA, McDiarmid RW, Hayek LC, and Foster M, editors. 1994. *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*. Washington, DC: Smithsonian Institution Press. 364 p.

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